



CHAPTER

11

Ecosystem Management

11.1 Wilderness and Ecosystem Management

This chapter outlines the development of the interagency ecosystem management strategy specified as a management objective in Chapter One. This strategy emphasizes the restoration and maintenance of natural processes and viable populations of all native species in natural patterns of abundance and distribution.

Ecosystem management is management driven by explicit goals, executed by specific practices, and made adaptable by research and monitoring based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function (Christensen, et al. 1996). The ecosystem concept provides the fundamental premise for regional management, and brings a compelling new vision to the ongoing debate over the future of public lands (Keiter 1989).

Within the national park system, all wilderness is classified as a *Natural Zone* (*NPS Management Policies*, 6:3). According to *NPS Management Policies* the primary objective in natural zones is the protection of natural resources and values for appropriate types of enjoyment while ensuring their availability to future generations. Wilderness requires additional consideration for outstanding opportunities for solitude or a primitive and unconfined type of recreation, i.e., a wilderness experience.

Natural resources will be managed with a concern for supporting basic and fundamental ecological processes as well as for individual species and features. Managers will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and ecological integrity of plants and animals (*NPS Management Policies*). Wilderness management includes maintenance and/or restoration of sustainable natural processes and viable populations of all native species in natural patterns of abundance and distribution (See Appendix L, Natural Conditions).

In wilderness, managers must maintain and protect ecological processes and natural conditions as well as provide for a wilderness experience (Wilderness Act, Section 2[a][c]). While this apparently contradictory *preserve and use* philosophy reiterates a fundamental premise of the NPS Organic Act (39 Stat. 535, 16 U.S.C. 1), the Redwoods Act Amendment (16 U.S.C. Section 1a-1) emphasizes a rigorous standard of protection, and prohibits use-related *derogation* of all park values (Lockhart 1988:31-32).

Protection of park values must be accomplished within the context of surrounding lands which often have conflicting management mandates. To meet wilderness objectives, wilderness management programs must develop a thorough understanding of the conditions and processes that make up the wilderness resource such as air and water quality, wildfire, and recreation to

name a few (Cole 1990b). Land use practices, such as mining, grazing, logging and road construction, occurring on adjacent lands may pose environmental threats to the Park. Attainment of the long-term management goals of protecting the ecological integrity of individual wilderness requires looking beyond the wilderness boundary and adopting what is called an *ecosystem management approach*.

11.2 Fundamental Scientific Principles for Ecosystem Management

Effective ecosystem management incorporates critical scientific precepts into an integrated land-management strategy:

- (1) *Spatial and temporal scales are critical.* Ecosystem function includes inputs, outputs, cycling of nutrients and energy, and the interactions of organisms. Boundaries defined for the study or management of one process are often inappropriate for the study of others. Ecosystem management requires the broadest, most comprehensive view (Christensen, et al. 1996).
- (2) *Ecosystem function depends on its structure, diversity and integrity.* Ecosystem management seeks to maintain biological diversity as a critical component in strengthening ecosystems against unnatural disturbance. Management of biological diversity requires a broad perspective and recognition that the com-

plexity and function of any particular location is influenced heavily by the surrounding systems (Christensen, et al. 1996).

- (3) *Ecosystems are dynamic in space and time.* Ecosystem management is challenging in part because ecosystems are constantly changing. Over time scales of decades or centuries, many landscapes are altered by natural disturbances that lead to a mosaic of successional patches of different ages. Such patch dynamics are critical to ecosystem structure and function (Christensen, et al. 1996).
- (4) *Uncertainty, surprise, and limits to knowledge are unavoidable aspects of ecosystem management.* Ecological systems are complex. Their dynamics are expressed in probabilities, and random (stochastic) influences may be strong (Meffe, et al. 1997). Ecosystem management acknowledges that, given sufficient time and space, unlikely events such as catastrophic fires and floods, are certain to occur. Consequently, conservationists should include safety margins in the design of management and recovery strategies. Adaptive management addresses this uncertainty by combining democratic principles (i.e., citizen and expert involvement; See Grumbine 1992: 204), scientific analysis, education, and institutional learning to increase our understanding of ecosystem processes. The consequences of

The supreme reality of our time is...the vulnerability of our planet.

John F. Kennedy

management interventions, and the improvement of the quality of data upon which decisions must be made, need to be addressed in ecosystem management (Christensen, et al. 1996).

11.3 Legal Basis for Ecosystem Management

Public law traditionally has accorded Federal land-management agencies considerable discretion in administering lands based principally on the agency boundary line (Keiter 1989). It should be noted that, based upon existing law, the judiciary has given ecosystem management a tentative stamp of approval (Keiter 1996). Current law not only emphasizes environmental protection as a primary responsibility of Federal land-management agencies, it also obligates land managers to view their responsibilities regionally, taking account of trans-boundary environmental impacts (Grumbine 1997). Ecosystem management will require unparalleled coordination among Federal agencies.

Ecosystem management does not necessarily alter the Federal land-management agencies' basic legislative mandates. Rather, it changes the agencies' approach to fulfilling their stewardship responsibilities through a better understanding, not only of ecologic relationships, but between the agencies themselves (Government Accounting Office 1994). Over the past several years, all four of the primary Federal land-management agencies (National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Man-

agement, and the Forest Service) have independently announced that they are implementing or will implement an ecosystem management approach (Keiter 1996; Government Accounting Office 1994; Keystone Center 1991, 1996; Grand Canyon Resource Management Plan 1997a:47-48). This gives hope of a new vision of public land management based on ecosystem principles rather than on traditional boundaries (Keiter 1989).

Unfortunately, disparate missions and planning requirements set forth in Federal land management statutes and regulations hamper and limit the implementation of such efforts. Although ecosystem management requires collaboration and consensus-building among Federal and non-Federal parties, incentives, authorities, interests, and limitations embedded in the larger national-land and natural-resource use framework constrain these parties' efforts to work together effectively (Primm and Clark 1996:143; National Research Council 1992; Goldstein 1992:184). Improving interagency relations demands innovative and bold approaches in light of the ideological and political history of interagency conflict (Grumbine 1991; 1994).

11.4 Implementing Ecosystem Management

Implementing sound ecosystem management requires taking practical steps that clearly identify what must be done and which agencies and parties must be involved (Government Accounting Office 1994). To facilitate

implementation of the ecosystem management concept, the Park established the Science Center Partnership Program (Resource Management Plan 1997a:47-48). The purpose of this partnership is to integrate the efforts of State and Federal land-managing agencies, American Indian Tribes, educational institutions, and science and environmental advocates to achieve the shared mission of protecting and managing natural and cultural resources within the Park.

Moving from concept to practice is a daunting challenge and will require the steps and actions outlined in Figure 11.1

(Christensen, et al. 1996; Government Accounting Office 1994):

step 1

Define Sustainable Goals and Objectives

Understanding regional ecology, including current ecosystem conditions and trends, the minimum level of integrity and functioning needed to maintain or restore ecosystem health, and the effects of human activities, is critical (Christensen, et al. 1996). Ecosystem management requires choices about desired future ecologi-

step 1	<p><i>Define Sustainable Goals and Objectives</i></p> <p><i>Goal 1.1 Protect Ecological Processes</i> <i>Objective a</i> Wild and Scenic Designation</p> <p><i>Goal 1.2 Protect Native Biodiversity</i> <i>Objective b</i> Protect and Preserve Genetic Integrity <i>Objective c</i> Protect Rare and Listed Species <i>Objective d</i> Maintain Long-term Viable Carnivore Populations <i>Objective e</i> Restore Altered Ecosystems</p> <p><i>Goal 1.3 Restore Altered Ecosystems</i> <i>Objective f</i> Restore Natural Fire <i>Objective g</i> Restore Extirpated Species <i>Objective h</i> Control Nonnative Plants and Animals <i>Objective i</i> Manage Naturalized Ecosystems <i>Objective j</i> Protect Air Quality</p>
step 2	<p><i>Restore Spatial Scales</i></p> <p><i>Goal 2.1 Develop and Implement a Regional Wildlife Conservation Strategy</i></p>
step 3	<p><i>Reconcile Temporal Scales</i></p>
step 4	<p><i>Develop Adaptable and Accountable Management Systems</i></p>

Figure 11.1
steps, Goals, and Objectives Needed to Implement Ecosystem Management

cal conditions (i.e., processes); the types, levels, and mixes of activities that can be sustained; and the distribution of activities over time among the various land units within the ecosystems (Government Accounting Office 1994).

Step 1, Goal 1

Protect Ecological Processes

The Wilderness Act (Section 2[c]) defines wilderness as an area *where the earth and its community of life are untrammeled by man*. Untrammeled lands are not subject to human controls that hamper the free play of natural forces (Stankey 1990:106). Other phrases in the Wilderness Act useful in defining goals include *primeval character and influence, wilderness character, and unimpaired condition*. These phrases imply that wilderness managers maintain or restore, to the extent possible, the wilderness conditions and processes existing prior to the period of increasing population, and growing mechanization that spurred Congress to pass the Wilderness Act (Cole 1995:42).

Park policy provides general direction for preserving, protecting, and interpreting the Park's ecological processes (Grand Canyon General Management Plan 1995:7). It also requires, to the maximum extent possible, the restoration of altered ecosystems to their natural conditions. Policy emphasizes reliance on natural processes to control populations of native species to the greatest extent possible (RMP 1997a:112; See U. S. Department of

the Interior. National Park Service. *Final Draft Strategic Plan*. 1996f:13).

Step 1, Goal 1 Objective 1a

Wild and Scenic Rivers

Riparian areas comprise some of the most diverse and endangered ecosystems in the southwestern United States (Noss and Cooperrider 1994; Noss and Peters 1995; Noss, et al. 1995). Protection of riparian water quality and instream flows requires protection of a variety of ecological processes. The Wild and Scenic Rivers Act provides the most comprehensive legal protection available for the instream values of rivers (U.S. Department of the Interior. National Park Service 1991, 4:26). The Act is potentially as significant to the Park's water resources as the Wilderness Act is to land resources (Gray 1988). Because an adequate supply of water is necessary to preserve the free-flowing conditions of designated rivers, the Act stands as the clearest expression yet of Congress' intent to assert Federal rights to water (Gray 1988). Designation as Wild and Scenic would afford long-term instream flow protection for the Colorado River in Grand Canyon and especially for its tributaries, some of which are already threatened by activities such as well drilling and development. More than 285 miles of the Colorado River and its tributaries in Grand Canyon National Park are eligible for consideration as wild or scenic rivers. The Park has committed to actively pursue the designation of eligible segments of the Colorado River and its tributaries as part of the

National Wild and Scenic Rivers System (GMP 1995:7). (See Appendix M, Wild and Scenic Rivers).

Step 1, Goal 1.2

Protect Native Biodiversity

Preserving viable populations of the Park's native flora and fauna requires management considerations of activities occurring beyond the Canyon's boundary (RMP 1997a:112). The NPS has committed to preserve natural genetic integrity and species composition, consistent with ecosystem processes (RMP 1997a:50). A general strategy for accomplishing this goal is outlined in the RMP (See RMP 1997a, Chapter 3; See Appendix L, Natural Conditions).

Step 1, Goal 1.2, Objective 1b

Protect and Preserve Genetic Integrity

The Park has also committed to preserve Grand Canyon's natural genetic integrity and species composition, consistent with ecosystem processes, and protect genetic diversity through perpetuating natural evolutionary processes and minimizing human interference (GMP:7; RMP:50,112). While the general strategy for accomplishing this goal is outlined in the RMP, further refinement of management objectives and implementation schedules will be addressed in subsequent revisions of the RMP and the Fire Management Plan (See Appendix N, Developing a Regional Wildlife Conservation Strategy).

Step 1, Goal 1.2, Objective 1c

Protect Rare and Listed Species

The GMP (p. 7) calls for preserving of critical processes and linkages that ensure the protection of rare, endemic, and specially protected (threatened/ endangered) plant and animal species. This also requires improving inventories, including invertebrates. The GMP (p. 17) also directs the park service to develop and implement an ecosystem approach to managing threatened and endangered species, and to institute an active research and recovery program.

Park policy requires the restoration, enhancement, and protection of populations of threatened or endangered species (RMP:50). Current funding levels are inadequate to achieve these objectives. Conservation strategies for these animals will be strengthened in subsequent revisions of the RMP and Fire Management Plan.

Step 1, Goal 1.2, Objective 1d

Maintain Long-term Viable Carnivore Populations

Carnivores play a significant role in ecological processes and constitute an important, if precarious, component of the region's fauna. The presence of self-sustaining populations of large carnivores, as part of a full complement of native species, is indicative of a healthy environment. Historically, the Grand Canyon ecoregion contained a diversity of mammalian carnivores,

including the mountain lion, bobcat, coyote, jaguar, grizzly and black bear. Persecution decimated wolf, grizzly bear, and jaguar populations and these creatures are extirpated in the Grand Canyon ecoregion (Brown 1983; Clark, et al. 1996). The current status of cougar, black bear, otter, and bobcat populations is unknown.

Historically, large-scale extermination and loss of habitat were the major threats to large carnivores. Now the most significant ecological threats to carnivore survival are related to loss and alteration of habitat resulting from exploitation of natural resources, permanent facilities, and associated infrastructure outside Park boundaries (Paquet and Hackman 1995:17).

Few conservation challenges demand as much innovation and interagency cooperation as the conservation of large carnivorous mammals. Key to this approach is the recognition that the fate of these animals depends on sociological, political, as well as biological solutions (Paquet and Hackman 1995: Preface). The Park will develop, as part of its Science Center Partnership Program, an interagency carnivore management program (RMP:47-48; See Appendix N, Developing a Regional Wildlife Conservation Strategy).

Step 1, Goal 1.3

Restore Altered Ecosystems

An overall goal of wilderness management is to allow a wilderness area to remain as wild and natural as possible.

This includes restoring wilderness character when it has been damaged by human use (Society of American Foresters [SAF] 1989a). Grand Canyon National Park is committed, to the maximum extent possible, to restore altered ecosystems to their natural conditions (GMP:7; See Appendix L, Natural Conditions). Managers not only have a responsibility to maintain, preserve and protect present wilderness qualities, but also to restore those which are below minimum standards specified in planning documents described below (*NPS Management Policies*, 6:2; Society of American Foresters 1989b).

Step 1, Goal 1.3, Objective 1f

Restore Natural Fire

The primary goal of the fire management program in the national park system is to integrate fire into sustainable naturally functioning ecosystems (Botti, et al. 1994:4). The Park's goals include ensuring the perpetuation of Park ecosystems and the restoration of natural fire regimes (GMP:17; RMP:50; Fire Management Plan:1).

In order to achieve this goal, the Park's Fire Management Plan will be updated to be consistent with the direction provided in the management objectives and other sections of the GMP (GMP:57). Revisions of the Fire Management Plan will address the restoration of the natural fire regime in wilderness areas, using practices consistent with this Wilderness Management Plan

(GMP: 57; See Wilderness Management Plan, Chapter 2).

Step 1, Goal 1.3, Objective 1g

Restore Extirpated Species

Extirpated species include the burrowing owl, southwestern river otter, razor-back sucker, zebra-tailed lizard, sage grouse, prairie dog, wolf, grizzly bear, jaguar, Colorado squawfish, and the bonytail and roundtail chubs (RMP:31; See Project Statement GRCA-270,100). The Park has committed to restore extirpated native animals wherever possible and will conduct feasibility studies on reintroducing extirpated species (GMP:17; RMP:112).

Restoration of extirpated animals requires varying degrees of effort as well as institutional tenacity. The reintroduction of condors is underway (Kiff, et al. 1996). Cattle interests eliminated the prairie dog from the South Rim in the 1930s (Brown, et al. 1987:195). Reestablishing burrowing owls, dependant on abandoned prairie dog burrows for nesting, may simply require the reintroduction of that otherwise ubiquitous rodent.

Habitat conditions in the mainstem river continue to favor nonnative species and preclude the successful reintroduction of extirpated native fish (Carothers and Brown 1991:84; RMP: Project Statement GRCA-N-270). Restoration measures necessary for successful reintroduction, ranging from increasing water temperatures by modifying Glen Canyon

Dam to removal of the dam, may prove expensive and controversial.

Reintroduction of large carnivores, such as the grey wolf, presents additional challenges. These species require enormous areas to maintain viable populations. Successful maintenance and restoration of these species will require development and implementation of a regional wildlife conservation strategy (Noss and Cooperrider 1994:161). The Park will establish partnerships, as described in the Science Center Partnership Program, to facilitate the design and implementation of a feasibility studies for the reintroduction of extirpated species (RMP:47-48; See Appendix N, Developing a Regional Wildlife Conservation Strategy).

Step 1, Goal 1.3, Objective 1h

Control Nonnative Plants and Animals

Invasive nonnative plants cause tremendous damage to park resources. Called exotics, or aliens, fast-growing nonnative plants, such as brome grasses, Russian olive, tamarisk, camelthorn, lovegrass and ravenna grass, encroach from populations established outside the Park. Consequently, the ecological balance achieved over many thousands of years is disrupted and often destroyed. Displacement of native plants directly and adversely affects the creatures dependant on often complex food-web relationships (U.S. Depart-

ment of the Interior. National Park Service 1996g).

The Park will preserve the Canyon's natural genetic integrity and species composition, consistent with ecosystem processes, including the elimination of nonnative plant and animal species wherever possible (RMP:50). A general management strategy and implementation program is outlined in the RMP (pp. 96-107). Control of exotic plant invasions will require additional cooperation with adjacent land managers. The necessary cooperative agreements and implementation programs will be coordinated by the Natural Resources staff.

Step 1, Goal 1.3 Objective 1i

Manage Altered Ecosystems

In 1992, Congress enacted the Grand Canyon Protection Act (Public Law 102-575) which instructed the Secretary of the Interior to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established. The Record of Decision (U.S. Department of the Interior, Bureau of Reclamation 1996) implemented a long-term monitoring and adaptive management program, as required by the Grand Canyon Protection Act, and outlined in *Operation of Glen Canyon Dam Final EIS's* preferred alternative (U.S. Department of the Interior, Bureau of Reclamation 1995).

Until Glen Canyon Dam was completed in 1963, the Colorado River's aquatic

system was dominated by native fish. These native species are specifically adapted to highly variable seasonal fluctuations in sediment load, flow, and temperature, and were severely impacted by dramatic changes resulting from the dam. The introduction of nonnative fish contributed to competition and direct mortality. Of the eight native species found in the River before 1963, three species are now extirpated (the Colorado Squawfish, and the bonytail and roundtail chubs).

The Park is committed, to the maximum extent possible, to the restoration of altered ecosystems to their natural conditions (See Appendix L, Natural Conditions), and will maintain, rehabilitate and perpetuate the inherent integrity of water resources and aquatic ecosystems (GMP:7; RMP:83). The NPS has also committed to manage the Colorado River to restore or "mimic," to the degree feasible, pre-dam natural and physical processes, including fish, wildlife and plant populations, and ecological relationships (RMP:50). In managing altered ecosystems, such as the River corridor, the Park will ensure the preservation of native components through the active management of nonnative components and processes. Achieving these goals through an interagency, adaptive management process is coordinated by the Grand Canyon Monitoring and Research Center.

Step 1, Goal 1.3, Objective 1j

Protect Air Quality

Grand Canyon enjoys some of the cleanest air remaining in the United States. This is a fragile resource, and existing levels of human-caused pollution create a clearly visible haze. The Park is committed to the preservation, protection, and enhancement of air quality and air-quality related values by ensuring compliance with the requirements of the Clean Air Act and the NPS Organic Act (RMP:90). The NPS will strive for the preservation of Grand Canyon's Class I airshed, and to protect it from within-Park, as well as, external degradation (RMP:50). Development of a regional air quality plan is addressed in the RMP (p.215).

Step 2

Reconcile Spatial Scales

Step 2, Goal 2.1

Develop and Implement a Regional Wildlife Conservation Strategy

Protection of native species requires developing an ecosystem-based conservation strategy for wildlife (including large carnivores) that transcends political boundaries. It also requires a concerted integrated research and management effort consisting of steps described in Appendix N, Developing a Regional Wildlife Conservation Strategy. The Park will establish partnerships, as described in the Science Center Partnership Program, to facilitate the design

and implementation of a wildlife conservation strategy (RMP:47-48; See Appendix N, Developing a Regional Wildlife Conservation Strategy).

Step 3

Reconcile Temporal Scales

Ecosystem management is challenging because, over time scales of decades or centuries, natural disturbances alter the landscape in both predictable and unpredictable ways. Environmental uncertainty, including variation over time in habitat quality and the impacts of natural catastrophes, must be integrated in the spatial evaluation of existing vegetative communities and wildlife population distribution (Murphy and Noon 1992:5). For conservation planning, reserve designs including connectivity should be evaluated at several spatial and temporal scales, ranging from daily movements within home ranges to long-distance dispersal events connecting populations once every generation or two (Noss and Cooperrider 1994:152). The design of management and recovery strategies must include risk analysis and safety margins which account for random (stochastic) influences, including catastrophic events. The regional wildlife conservation strategy proposed above in Step 2 will include these temporal considerations (See Appendix N, Developing a Regional Wildlife Conservation Strategy).

In addition, ecosystem management must deal with time scales that tran-

scend human lifetimes, and requires long-term planning and commitment (Christensen, et al. 1996). Land management agencies, accustomed and often required to make decisions on a fiscal-year basis, will need flexibility and support to achieve long-term ecosystem management goals. This issue will be addressed in subsequent planning revisions and as part of establishing ecosystem management partnerships.

Step 4

Develop Adaptable and Accountable Management Systems

Understanding ecosystems requires collecting and linking large volumes of scientific data. Although ecosystem management will require greater reliance on ecological and socioeconomic information, the available data, collected independently by various agencies for different purposes, are often not comparable and insufficient, and scientific understanding of ecosystems is far from complete (Government Accounting Office 1994). Furthermore, there is still much uncertainty about how ecosystems function. This uncertainty contributes to strong differences in the interpretation of scientific evidence (Government Accounting Office 1994).

Successful ecosystem management requires institutions that are adaptable to changes in ecosystem characteristics and in our knowledge base. The conservation of native biodiversity should be viewed adaptively and dynamically in terms of ecological processes. The

methodology used to obtain information and implement a region-wide adaptive management strategy must be hypothesis-driven, and based on solid, objective science (See Weaver 1993; Ruggiero, et al. 1994). Agencies must adapt management strategies on the basis of continually researching, monitoring, and assessing ecological conditions (Christensen, et al. 1996; Government Accounting Office 1994). By constructing networks for information sharing and learning with partners, managers expand their role as facilitator in a large-scale societal conversation about conservation (Grumbine 1997). To act prudently, managers need to understand how the current Grand Canyon ecoregion evolved and the ways in which humans have altered, often radically, the structure of the ecosystems inhabited by native species. Without understanding the present-day condition and its historical origins, managers have little hope of ensuring that future decisions will be beneficial for native biodiversity (Paquet and Hackman 1995:29).

The development of an ecosystem research program, based on a baseline inventory and long-term monitoring program is a Park priority (GMP:17). The RMP (p. 50) specifies, through the development and operation of a science-based comprehensive natural resource inventory and monitoring program, the understanding of the status and trends of populations, communities and ecosystems. The completion of the Glen Canyon Dam Environmental Impact Statement (EIS) initiated a process of adaptive river manage-

ment whereby the effects of dam operations on downstream resources would be assessed and the results of those resource assessments form the basis for future modifications of dam operations (U.S. Department of the Interior. Bureau of Reclamation 1995). The Adaptive Management Program (AMP) was developed and designed to provide a process for cooperative integration of dam operations, resource protection and management, and monitoring and research information (U.S. Department of the Interior. Bureau of Reclamation 1995:34-38). In addition, the Park is developing a new, comprehensive research program within the Science Center to obtain accurate information about the Grand Canyon's resources, ecological processes, and human influences. The role of partnerships will be a key element in achieving Park objectives (RMP:47-48;174).

11.5 Summary of Changes and Actions

- Conservation strategies for the restoration, enhancement, and protection of populations of threatened or endangered species will be strengthened in subsequent revisions of the 1997 Resource Management Plan and Fire Management Plan.
- The Park will develop an inter-agency management program to maintain long-term viable carnivore populations.
- Revisions of the Fire Management Plan will specifically address the restoration of the natural fire regime in wilderness areas, using practices consistent with the Wilderness Management Plan.
- The Park will establish partnerships to facilitate the design and implementation of feasibility studies for the reintroduction of extirpated species.
- The Park is committed to actively pursue the designation of eligible segments of the Colorado River and its tributaries as part of the National Wild and Scenic Rivers System.
- Further refinement of management objectives and implementation schedules to protect and preserve genetic integrity will be addressed in subsequent revisions of the 1997 Resource Management Plan and the Fire Management Plan.
- The Park will strive to preserve the Canyon's natural genetic integrity and species through the elimination of nonnative plant and animal species wherever possible. Park staff will develop the necessary cooperative agreements and implementation program with agencies and nongovernmental organizations.
- To the maximum extent possible, the Park will restore altered ecosystems, and maintain, rehabilitate and perpetuate the inherent integrity of aquatic ecosystems. Achieving these goals will be accomplished

through an interagency, adaptive management process coordinated by the Grand Canyon Monitoring and Research Center.

- The Park will establish partnerships to facilitate the design and implementation of a wildlife conservation strategy.
- The Park will expand its comprehensive research program within the Science Center to obtain accurate information about the Grand Canyon's resources, ecological processes, and human influences. The role of partnerships will be a key element in achieving this Plan's objectives.

CHAPTER 12

Monitoring and Research Programs

Integral to the Limits of Acceptable Change (LAC) framework is the implementation of monitoring programs which identify and track the condition of wilderness resources and values. At Grand Canyon, monitoring programs for campsites, trails, archeological sites, and visitor experience have been in place for several years. This chapter will describe each of those programs. The Monitoring Matrix (Figures 12.1 - 12.5) summarizes the indicators, standards, management actions, and monitoring programs for specific resources.

Monitoring by itself cannot mitigate the impacts that have already or are currently occurring to natural and cultural resources and the wilderness experience. Monitoring is not an end product; it is a method for tracking and evaluating resource conditions and wilderness values so managers can develop appropriate actions for protection. Law enforcement and public education provide avenues for preventing future impacts, but cannot address the impacts which have already occurred. For long-term monitoring to be worthwhile, it is essential that the monitoring programs be directly linked with other treatment programs that can address the ongoing impacts to natural resources including wildlife, vegetation, and water; to nonrenewable heritage resources; and those values that characterize a wilderness experience. This integrated program is outlined in Chapter 13, Rehabilitation and Restoration of Recreational Impacts.

12.1 Campsite Monitoring Program

At Grand Canyon, a campsite-inventory program began in 1981, prior to the establishment of the use-area management strategy. The early program was built on an overall inventory of the most popular wilderness campsites. The 1983 Backcountry Management Plan mandated a monitoring plan to evaluate campsite condition and distribution. At that time, however, specific management objectives were not articulated. The 1988 Backcountry Management Revised Plan established management objectives which set standards for campsite condition and distribution, with the exception of designated sites in use areas within the Threshold Opportunity Class. This Wilderness Management Plan further describes indicators and standards for all wilderness opportunity classes, and identifies potential management actions to meet specific management objectives.

The current campsite monitoring program was adapted from the ecological studies done by Cole (1985, 1989a). The methodology includes an assessment of several variables or "indicators," culminating in a campsite-condition rating. The overall condition is rated on the type and level of impact to each campsite. The standards describe the relative amount of impact, or the "Condition Class" of each campsite. The Condition Class is the overall descriptor used to evaluate management objectives for desired campsite conditions. Standards are also described for the total amount of im-

pacted ground or barren core in any square mile within the use area. (Barren core is defined as, an area devoid of vegetation and organic litter, with compacted soil and trampled perimeter vegetation). The campsite-monitoring methods, rating system, and procedures are described in the Campsite Monitoring Manual included as Appendix O.

The distribution of campsites within use areas has sociological and ecological management implications. This is of greatest importance for use areas with at-large camping. The proximity of campsites to one another has a direct bearing on the number and type of encounters hiking parties may have. The standards describe the maximum number of campsites in any square-mile area.

Campsite-monitoring data collection and analysis have been documented since 1988. The most recent results of the monitoring data indicate a negative trend in campsite condition overall. When comparing field data to management objectives, the monitoring data show that management standards are not being met, specifically for campsite condition and campsite density (Hoffman 1989; Jalbert 1993 and 1996).

Management treatments have been applied to rehabilitate these impacted campsites and surrounding areas. These treatments have included revegetation, obliteration of social trails and barren ground, and definition of trails and campsites. The campsite monitoring program has also produced information that has resulted in changes to use

area boundaries and campsite classification. These changes are described in Chapter Six, Wilderness Campsite Management. These treatments or management actions have been implemented to ensure conformity with environmental and sociological standards developed for each Opportunity Class.

Under this Wilderness Management Plan, the current methodology of campsite assessment will continue. Wilderness Rangers and Resource Specialists will establish a monitoring schedule based on use statistics and trend information. In addition, emphasis will be placed on conducting an inventory of campsites in use areas within the Wild Opportunity Class. (See Figure 12.1, Campsite Condition and Distribution).

12.2 Monitoring Visitor Experience

A sociological study of backcountry users was conducted in a twelve-month period beginning in June 1984 and concluding in December 1985. The purpose of the study was to develop a sociological database to provide a basis for effective management decisions when combined with resource information. The objectives of the study were 1) to identify the overnight users of the Park's backcountry, 2) to determine user motivations, expectations and preferences, 3) to measure user levels of satisfaction with their Grand Canyon experience, 4) to evaluate user reaction to the reservation and permit system, 5) to

In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness.

The Wilderness Act of 1964

develop a sociological monitoring system to be used by Park staff, and, 6) to suggest management actions that best meet social needs of visitors (Underhill, et al. 1986).

A significant outcome of this study was the development of management objectives in the 1988 Backcountry Management Plan that described desired social conditions. The sociological standards describe the acceptable number and duration of contacts an overnight user may have while hiking and at campsites. These standards are based on data which correlates users' reported satisfaction level with the number of other parties they encounter while travelling or at campsites. Wilderness researchers have found that most overnight hikers are more sensitive to being within sight or sound of others while at camp, compared to when they are hiking (Underhill, et al. 1986; and Hendee, et al. 1990).

In keeping with goals outlined in the Park's General Management Plan, wilderness areas will be managed so visitors have the "opportunity for a variety of personal outdoor experiences, ranging from solitary to social." The standards for maintaining or enhancing visitor experience are described for each Opportunity Class. The Wilderness Act of 1964 also defines a wilderness experience as one with "outstanding opportunities for solitude or a primitive and unconfined type of recreation." The standards for contact levels at the primitive and wild end of the recreational opportunity spectrum therefore reflect the desired experience. On the other hand, opportunities for more

social contact are available in the wilderness Threshold Use Areas as well as in the Cross-Canyon Corridor.

Two monitoring programs were developed from the 1986 sociological study. One program was established to collect data on the actual number of encounters an overnight hiker may have. A random sampling of hikers in each Opportunity Class were asked to complete a short survey form by recording the number of people and groups they encountered during the day and at their camp, and to rate their level of satisfaction associated with each contact. Analysis of the data determined 1) the number of contacts made, and 2) at what level the number of contacts became unacceptable. The results were measured against the management objectives described for each Opportunity Class.

The second monitoring program involved a lengthy questionnaire based on the original sociological study. A mail-back survey was completed by overnight hikers who had done a recent trip. This monitoring program, which was conducted on a five-year cycle, provided Park staff with feedback on management actions and policies. The survey also provided basic demographic information, background on the user's skill level, and information on visitor expectations and motivations. These data were considered for determining changes in the permitting operations and group-size limits, and for developing a structure for the cost recovery program. Overall, this program provided an evaluation of man-

agement objectives, and an assessment of strategies for providing a range of opportunities for personal experiences.

This Wilderness Management Plan establishes a schedule for implementing a monitoring program based on sociological research and previous monitoring programs. The monitoring program will be initiated by 2002, and will focus on users in the wilderness areas of the backcountry, specifically use areas within the Threshold, Primitive, and Wild Opportunity Classes (See Figure 12.2, Visitor Experience).

12.3 Archeological site Monitoring

During the late 1980s, Grand Canyon National Park initiated a monitoring program for archeological sites in the backcountry and wilderness. Prior to this time, monitoring of archeological sites occurred on a highly irregular basis, and was focused primarily on highly visible structural sites that were easily accessible from the Colorado River corridor. Beginning in 1989, Park archaeologists initiated a more comprehensive monitoring program that included sites along primary hiking trails and other heavily visited backcountry and wilderness areas.

The current monitoring program improves management and protection of cultural resources by 1) identifying sources of impacts to archeological sites, 2) prioritizing sites for future monitoring and treatment, and 3) providing information for the development and implementation of plans to mitigate

impacts and prevent or substantially reduce those impacts in the future. To do this, it is necessary to establish detailed baseline information on the current attributes and condition of sites, as well as gather information suitable for evaluating long-term impact trends.

The wilderness areas of Grand Canyon National Park have never been systematically inventoried for cultural resources, so baseline information is still lacking. The only trails that have been systematically inventoried are the Bright Angel, North and South Kaibab, plus the uppermost portions of the Grandview and Hermit Trails. Most documented sites in the backcountry are known from reconnaissance helicopter surveys in the mid-1960s and early 1970s, from a few small-scale reconnaissance pedestrian surveys by outside researchers and Park personnel, and from sporadic visitor reports. Many of the "known" sites have not been revisited by a trained archaeologists since they were originally reported (some as long ago as the 1930s). In many cases, the only available information consists of an inaccurate map and a few lines of descriptive text. Most sites in the wilderness need to be relocated and documented according to current standards so they can be incorporated in the monitoring program.

The current archeological monitoring program was adapted from a program developed by Cole (1985, 1989a) for monitoring impacts to wilderness campsites. Elements from archeologi-

cal monitoring programs in other southwestern national parks are also incorporated. The methodology involves ranking several impact variables to produce an overall condition class assessment. Change in site condition is documented with repeat photographs, supplemented by written descriptions.

Unlike the campsite-monitoring objectives, levels of acceptable impacts to archeological sites do not vary by Opportunity Class. The Park is mandated by law to protect the integrity of all significant archeological resources, no matter where they occur in the Park. The monitoring program serves mainly to document whether impact levels are increasing, decreasing, or continuing without significant change. Sites which have received or are currently receiving high levels of impact are given the highest priority for future intervention, while those with no or low impact levels continue to be monitored at regular intervals based on a monitoring priority ranking system.

The distribution of archeological sites in the backcountry has important sociological and ecological implications for wilderness management because many of the environmental attributes that attracted prehistoric occupants to settle in a location 1000 or 5000 years ago such as level terrain, shelter from the elements, proximity to water and trails, or a good view are the same ones that attract modern campers. Consequently, many places occupied by prehistoric and historic inhabitants of Grand Canyon are still used by visitors as camps.

Many impacts from on-site camping can be reduced or eliminated through improved visitor education, physical deterrents, stabilization and restoration techniques, or formal site closures. Generally, the intervention strategy that is least intrusive to the visitor will be tried first, and the results will be monitored to see if the desired results (elimination or substantial reduction of impacts) are achieved. If monitoring reveals that desired results have not been achieved, more direct forms of intervention can be implemented. If none of the intervention techniques achieve the desired results, excavation may be undertaken as a last resort.

In a few wilderness areas, archeological sites offer the only reasonable place to camp. If the site still retains archeological integrity and contains potentially valuable information about the past, the National Park Service is legally obligated to mitigate impacts that are occurring to the site from this use. In most instances, mitigation will involve recovering and preserving information from the site by means of a professional archeological excavation. In some instances, it may be possible to stabilize a site and protect its integrity without complete excavation, but some level of archeological excavation is usually required as a component of stabilization.

This Wilderness Management Plan establishes a systematic method of archaeological inventory and monitoring in wilderness use areas. A schedule will be established based on use trends and patterns, and will focus on

areas that receive moderate to high use levels. Archaeological site surveys, inventories, and compliance will be conducted prior to developing resource protection action plans. (See Figure 12.3, Cultural Resources).

12.4 Monitoring Water Resources

The objectives of the water resource inventory and monitoring program are 1) inventory all Park water resources, 2) develop baseline water resource information on water quality and quantity for a wide variety of management needs, including identification and mitigation of human health hazards, identification and mitigation of human impacts to the resource, and water rights issues, 3) develop and maintain high-quality data for streamflow and water chemistry on South Rim springs, 4) interpret water resources from the Grand Canyon, and 5) identify future research and monitoring needs. (RMP 1997a)

An intensive, three-year seasonal water quality sampling program was conducted from 1990 to 1994. The study sites were located in 20 Park tributaries along the Colorado River. The objective of the study was to inventory water quality characteristics of state-protected waters at locations of potential impact (Mazzu 1995).

Although the intensive study focused on many high-use recreational tributaries, it did not include wilderness source areas for creeks and springs that dry up before reaching the Colorado River. These water sources are vital to overnight

hikers in the Grand Canyon wilderness. In recent years, intensive studies have been conducted on water quantity and quality at popular wilderness destinations, many of which address water chemistry of ground water emerging from Canyon springs (Rihs 1997).

The water quality and flow data-monitoring program is conducted at periodic intervals annually. Water quality data includes discharge, conductivity, dissolved solids and oxygen, alkalinity, turbidity, and temperature. Water quality information includes bacterial analyses for fecal coliform and streptococcus, chemical analyses of several variables, and testing for radionuclides and radioisotopes at selected sites. Monitoring results are reported annually and included in periodic updates on water availability and quality for public use.

This Plan establishes a schedule for monitoring water quality in tributaries within wilderness use areas. The schedule will be based on use trends and patterns, and will focus on use areas with moderate to high use levels. Site specific water quality data will be provided to the Backcountry Office for visitor education and public information (See Figure 12.4, Water Resources).

12.5 Monitoring Trail Condition

Over 400 miles of established trails exist in Grand Canyon National park. Of this total, approximately 380 lie

within the proposed wilderness areas. Some contain historic features, and most trails have received little or no stabilization or rehabilitation work, and currently exist in various states of disrepair. Until recently, monitoring trail conditions focused on problem segments. A trail-condition survey using a descriptive log of trail problems and prescriptive actions has proven useful at Grand Canyon in developing action plans for trail rehabilitation.

While there has been no systematic method for trail-condition monitoring, Park staff have conducted trail surveys on approximately 150 miles of the wilderness trail system. This Plan establishes a strategy for routinely conducting trail-condition surveys on wilderness trails and routes. The focus will be on trails that contain historic features, and those that receive moderate to high use by backpackers and river users. Trail-condition surveys will be conducted in conjunction with routine trail maintenance and rehabilitation river trips. Following rehabilitation or restorative work, trails will be monitored on a cyclic basis (See Figure 12.5, Trail Condition; Chapter 7, Trail Management).

Figures 12.1-12.5 Wilderness Resources Monitoring Matrix

The following matrices summarize the indicators, standards, management actions, and monitoring programs for specific wilderness resources and values. Below is a brief description of the components of the matrix.

Indicators can be measured to track change in conditions caused by human activity. The purpose of indicators is to focus data collection efforts on what is important. Monitoring indicators are a means to ensure that standards are being met.

standards are developed to ensure desired conditions of wilderness resources and values are maintained or enhanced. These are measurable statements that describe the resource and experience conditions that are considered realistic, attainable, and acceptable. Standards are specific and measurable so they clearly trigger the need for corrective management action. They are established to promote achievement of desired conditions.

Management Action(s) to be Implemented are identified and may be implemented as needed depending on the resource conditions. The NPS recognizes that, especially in wilderness areas, the lowest level of intervention will be implemented to address problems. In many cases, indirect management actions such as visitor education accompany more direct actions such as site rehabilitation to achieve desired conditions.

Monitoring Programs currently being conducted are identified. The frequency of each program is determined by the staff specialists based on the level of potential impacts to the resources in specific wilderness areas. Where monitoring programs have not been identified, resource inventory will be conducted.

Insert Figure 12.1: Campsite Condition and Distribution

Insert Figure 12.2: Visitor Experience

Insert Figure 12.2 Visitor Experience

Insert Figure 12.3: Cultural Resources

Insert Figure 12.4 : Water Resources

Insert Figure 12.5 : Trail Condition

12.6 Research in Wilderness

A wide range of scientific studies are conducted within wilderness management areas in Grand Canyon National Park. Wilderness-related topics include studies of backcountry and river recreation and of ecosystem management alternatives. An overview of the entire research program, including a listing of current science information needs is contained within the Grand Canyon National Park Resource Management Plan (1997a). A complete listing of ongoing studies is prepared annually as the compiled Investigator's Annual Report (available on request from the Grand Canyon Science Center).

Information gained through inventories, monitoring, and research is essential for scientifically based resource management. Collection of complete, accurate, and high-quality data is basic to science, and frequently study objectives can be accomplished only through use of the best available technology. However, the tools and methods of scientific study can also have undesirable impacts on the character of wilderness. Such study-related impacts can be temporary or long-lasting. Examples of temporary effects include visitor disturbance, noise from survey helicopters or boats, and brightly colored dyes released during hydrologic studies. Longer lasting effects can include permanent markers, scarring of woody vegetation and rock outcrops, excavation pits, and equipment installations. In Grand Canyon National Park, every reasonable effort is taken to minimize impacts while simulta-

neously maximizing the benefits of scientific investigations (See Appendix B, *NPS Management Policies*).

Approval for scientific studies within wilderness areas is guided by principles established by Congress. Among these principles are that the imprint of man's work be substantially unnoticeable, that the wilderness area have outstanding opportunities for solitude, that wilderness be preserved and used in an unimpaired condition, and that wilderness contain ecological, geological, or other features of scientific, educational, scenic, or historical value. In many cases, Federal law and Departmental policy allow sufficient latitude to achieve the investigators' objectives

An area should not be excluded from wilderness designation solely because established or proposed management practices require the use of tools, equipment or structures, if these practices are necessary for the health and safety of wilderness travelers, or the protection of the wilderness area. Managers will use the minimum tool, equipment or structure necessary to successfully, safely and economically accomplished the objective... economic factors should be considered the least important of the criteria. The chosen tool should be the one that least degrades wilderness values temporarily or permanently (U.S. Department of the Interior, National Park Service 1972).

Grand Canyon National Park applies a multistep review process to ensure that studies within wilderness management areas will benefit the public and the park units in which the studies are conducted. Permits are required for scientific research, specimen collection, and for access to restricted locations. Scientists wishing to work within the Park are invited to submit proposals specifically outlining the objectives, methods, location, and expected benefits of their proposed work. Proposals are required of both Federal and non-Federal investigators. Proposals undergo scientific and administrative review prior to the permitting decision. Scientific reviews are generally conducted by independent qualified subject-matter experts, who are invited to comment on the significance and urgency of the study, validity of the methods, and qualifications of the scientist. Administrative reviews, which are conducted by park management, are intended to evaluate the proposed activities relative to standards of legislative authority, and visitor and resource protection. Well designed studies with a high potential for positive benefits to the Park are generally reviewed favorably.

Guidelines for the preparation of study proposals and general research permit conditions and restrictions are contained within the *Application Procedures for Research and Collecting Permits, December 1996, Grand Canyon National Park and Glen Canyon National Recreation Area* (1996). Copies are distributed to prospective researchers on request. This document provides general guidance about conducting scientific studies within these

parks, and permitting schedules. It contains the application form used for requesting research and collecting permits; proposals are accepted throughout the year. Each proposal is evaluated on its own merit, starting with the premise that opportunities for resource-based scientific investigation are basic to the Park's mission, and that the information gained through scientific studies will help protect park resources and benefit public programs.

Consideration for wilderness-related issues is part of both the scientific and administrative review processes. A conceptual representation of the administrative-review process pertaining to wilderness issues is contained in Figure 12.6. When potentially significant effects to Park resources, safety concerns, or excessive costs are discovered in the course of a permitting evaluation, joint reevaluation of the proposed study by the principal investigator and Park management may be required.

Investigators who concur with the stipulations of their permits can be authorized to conduct studies within the Park for as long as five years, depending primarily on their study plan. Progress on all studies is reevaluated at least annually. When necessary, permits can be canceled for noncompliance or significant deviations from the study plan.

Insert Figure 12.6 : Wilderness-related decision matrix for scientific permit applications

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Insert Figure 12.6 : Wilderness-related decision matrix for scientific permit applications

12.7 Summary of Changes and Actions

- Continue Rapid Campsite Assessment methodology for campsite monitoring. Establish a monitoring schedule based on use statistics and trend information. Conduct an inventory of campsites in use areas within the Wild Opportunity Class
- Implement a monitoring program based on sociological research and previous monitoring programs by 2002. Focus on users in wilderness areas (Threshold, Primitive and Wild Opportunity Classes)
- Develop a systematic schedule of archaeological inventory and monitoring in wilderness use areas based on use trends and patterns. Archaeological site surveys, inventories, and compliance will be conducted prior to developing resource-protection action plans
- Establish a strategy to conduct routine trail-condition surveys on wilderness trails and routes. Focus will be on trails that contain historic features, and those that receive moderate to high use levels by backpackers and river users. Conduct trail-condition surveys will be conducted in conjunction with routine trail maintenance and fall and spring rehabilitation river trips. Monitor trail-restoration work, on a cyclic basis
- Prepare biennial monitoring reports for Park staff including wilderness rangers, trail crew, and interpretation staff
- Continue to evaluate the tools and methods of scientific study for impacts on wilderness character applying the minimum-requirement decision process.

CHAPTER 13

Rehabilitation and Restoration of Recreational Impacts

An overall goal of wilderness management is to keep and make wilderness as wild and as natural as possible. This includes restoring wilderness character when it has been damaged by human use (Society of American Foresters [SAF] 1989a). Managers not only have a responsibility to maintain, preserve and protect present wilderness qualities, but also to restore those which are below minimum standards (*NPS Management Policies*, 6:2; SAF 1989b).

13.1 Revegetation and Site Rehabilitation

The primary objective of Grand Canyon's revegetation program is to restore native vegetation cover in impacted areas (Grand Canyon Resource Management Plan 1997a:97). This effort consists of four distinct yet interrelated aspects: 1) rehabilitating and restoring impacted sites to a natural condition; 2) establishing a dependable seed and propagule source for restoration efforts; 3) educating the public and workforce; and 4) monitoring the program's effectiveness.

Rehabilitating Impacted Sites

There are at least two critical steps in restoring impacted sites. The first is to identify the area of concern and determine why impacts occurred. For example, if multiple trailing is the issue, it would make little sense to intervene with an aggressive multiple-trail rehabilitation project without first delineating an adequate trail to accommodate recreationists. Otherwise, a new mul-

tiple trail pattern will develop. The second step is to determine the nature of the impacted site requiring rehabilitation and devise an appropriate mitigation plan.

Restoration

Restoration to a "natural" condition (See Appendix L, Natural Conditions) includes restoration and maintenance of natural processes and viable populations of all native species in natural patterns of abundance and distribution. For this discussion, the term "impact" will refer to human-induced alterations of natural processes, native biotic community compositions, and/or aesthetic elements.

In widespread degraded areas restoration may consist of landscape-scale actions, such as reducing or removing nonnative grazing animals and/or the restoration of natural fire regimes (See Chapter 11, Ecosystem Management). The restoration of small-scale sites resulting from recreational impacts, usually consists of returning impacted sites to the vegetative composition and aesthetic conditions of the area.

Rehabilitation

Rehabilitation consists of returning an impacted site or area to a specified (generally *natural*) level of soil conditions and biological productivity (including vegetation composition) (See Appendix L, Natural Conditions). Aesthetic considerations are also important. Since complete restoration is a long-term process, the steps taken by

managers generally constitute a sequence of rehabilitation actions which anticipate eventual restoration to a natural condition.

Rehabilitation of High-Use Sites

Given the same environmental setting, more highly impacted sites will require longer recovery periods. When different environmental settings are compared, however, it is difficult to predict how long recovery will take merely on the basis of how badly the site is impacted. There is some evidence that differences in recovery rates between different environments may exceed differences in deterioration rates. In addition, it may be more effective to speed recovery rather than slow deterioration (Cole 1994).

Sometimes anticipatory actions may not have the intended effect. For example, the seemingly logical strategy of rotating use—temporarily closing sites to allow recovery or frequently relocating trails—is likely to be counterproductive because it usually results in a pronounced increase in total impact. Many closed restoration sites recover slowly as displaced activity creates new impacts as visitors go elsewhere. This increases the areal extent of impact and therefore, total impact (Cole 1994).

The most likely effective strategy in controlling impacts in high-use sites is simply to select durable sites and to confine use to as small an area as possible. The characteristics of durable campsites and other areas of concentrated use include (1) either lack of

ground-cover vegetation or presence of tolerant vegetation (grasslike plants are most tolerant—short woody plants are least), (2) an open rather than closed tree canopy, (3) thick organic soils, and (4) a relatively flat but well-drained site.

Rehabilitation of Little-Used Sites

Conversely much can be gained by reducing use in places that receive light use. Study results emphasize the importance of minimizing impacts in parts of the backcountry that are currently relatively undisturbed. Most of the backcountry falls under this category, especially the Esplanade and Tonto regions. This Plan emphasizes visitor education to encourage low-impact behaviors, such as selection of durable sites, as a key element in minimizing recreational impacts (See Chapter 10, Interpretation, Education, and Information).

Other management strategies with the most promise include (1) controlling type of use, (2) avoiding use during seasons when soil and vegetation are particularly vulnerable to disturbance (e.g., North Rim meadows) (3) confining use in popular places, and (4) perhaps, dispersing use widely in lightly used places. This latter strategy is risky and if attempted, conditions will be monitored closely (Cole 1994).

*I know it is a
daring thing--
for a man
whose life
lasts 40, 50,
60, 70, or 80
years to be
talking in
terms of
eternity,
but that is
indeed what
we are doing.
We are think-
ing of the
eternity of
the past that
now exists in
these areas of
wilderness,
and we have
the presump-
tion to say
that we are
going to do
our best to
make it pos-
sible for those
areas from
the eternity
of the past to
exist on into
the eternity
of the future.
That is our
faith.*

*Howard
Zahniser
Author
of
the
Wilderness Act*

13.2 Site Restoration Recommendations

Disturbed sites in desert environments are inherently difficult to revegetate (Gelt 1993; Jackson, McAuliffe, and Roundy 1991; Heim 1994; Young, et al. 1994). Poor soil properties, extremely high surface temperatures, and lack of moisture retard or even prevent seedling establishment. On most sites, the relative contribution of wind and water to erosion in semiarid environments depends on soil conditions, and topography, and the nature and extent of impacts. The resulting erosion causes an almost irreversible loss in productivity (Ladyman and Muldavin 1996). Since geologic soil formation is estimated to be one inch per 300-1,000 years, significant soil loss on even a modest scale can be devastating. Erosional processes may also lead to an impoverished soil seedbank (Francis 1994). Site restoration recommendations include

- using the Minimum-Requirement Decision Process (Appendix D)
- identifying the source of impact
- preparing the site, including
 - moisture
 - catchments
 - mulch and shade
 - ripping
 - seeding

These elements are discussed in detail below.

Minimum Requirements

Grand Canyon National Park will apply only the minimum tools, equipment, device, force, regulation, or practice that will bring the desired result (See Appendix D, Minimum Requirement Decision Process). This not only applies to methods of transporting personnel and equipment to the site, and the selection of the types of tools required for successful implementation, but also the selection of materials needed for restoration. Materials used for soil stabilization and mulching will consist of native vegetation, soil, and rock sources, if possible. Potentially intrusive materials such as jute matting (See Mulch and Shade below), will be carefully camouflaged. Work projects will consist of the minimum number of participants (generally less than the maximum hiker group size of 11). If possible, a project date will be selected that avoids conflict with recreational users. In general, project dates, tools, and materials will be selected that least impact the resource and visitor experience.

Identify the source of Impact

Generally, rehabilitation of natural perturbations such as floods, fire and landslides will not be attempted in wilderness. Exceptions may be made regarding exotics or rehabilitation of degraded landscapes (See Chapter 11, Ecosystem Management). Unacceptable recreational impacts, as defined through the LAC process, require active intervention. As dis-

cussed above, it makes little sense to initiate a rehabilitation project without understanding the cause of the original impact. Attempts to reduce the size or number of barren core areas (barren core areas have compacted soil, trampled perimeter vegetation, and are devoid of vegetation and organic litter) will be futile if the allowed group size or total group numbers exceed the area's capacity. Elimination of multiple (social) trailing may be counterproductive without first delineating an adequate primary trail. Otherwise, the area of impact simply increases as "rehabilitated" trails reappear and new ones develop. Since many archeological features occupy sites providing shelter, shade, and proximity to water—conditions deemed desirable by modern hikers—restoration may not succeed unless adequate alternative sites and education are provided, or as a last resort, the area is closed to camping or visitation.

Site Preparation

Moisture

Moisture is not only necessary for immediate germination and growth, but seedlings must grow large enough to tolerate drier, normal conditions. Even in undisturbed deserts, seeding establishment occurs infrequently and only when there is unusually plentiful rainfall. Irrigation is beneficial in establishing vegetation, but in wilderness settings it is often impractical, impossible, or in some cases may exceed minimum tool. Some of the actions Grand Canyon may take include, contoured water catchments (to concentrate moisture); mulching with coarse,

woody debris that is slow to break down; and seeding prior to winter rains to increase the probability of successful seedling establishment (Jackson, McAuliffe, and Roundy 1991; Gelt 1993).

Catchments

The use of contoured berms (resembling contour plowing) on slopes, depressions, and checks (small dams) in arroyos provides for water concentration, and greatly enhances soil moisture. Since these measures require some degree of site manipulation, care will be taken to assure that only low-key, unobtrusive, minimally visible features consisting only of natural materials are used. An archaeological evaluation as part of the compliance process is necessary before any surface disturbance occurs.

Mulch and Shade

Mulch reduces soil surface temperatures and greatly improves soil moisture accumulation, not only near the surface but at depth (Jackson, McAuliffe, and Roundy 1991). The preferred mulch in wilderness settings consists of woody debris and natural leaf litter (preferably from beneath native trees and large shrubs). Locally derived leaf litter provides additional benefits such as a source of native seeds and important microbiotic soil elements. It is also readily removed by winds unless stabilized through soil scarification (roughing the surface) or covering with heavier woody debris or commercially prepared jute matting.

For this discussion, jute matting refers to commercial blanket or matting consisting of wood fibers or burlap which is used to stabilize exposed soils. Jute matting also functions as a mulch by reducing soil temperatures and increasing soil moisture, as well as capturing windblown seeds. It is useful when the restoration surface area is large, especially when native mulch sources are limited. Because of its visually intrusive nature, jute matting will be used only when native material sources are insufficient for adequate site preparation. Native woody debris and leaf litter will be used to camouflage the jute matting. In addition, some jute matting comes with a fine, plastic netting that degrades in sunlight. Since animals ranging in size from elk to reptiles can become entangled, this netting will be removed after placement.

Another useful (albeit labor intensive) method of shading or blocking restoration sites is to “plant” dead brush and deadfall in the disturbed area. The material used consists mainly of dead brush found in various states of abundance. If carefully and patiently done, this method can facilitate restoration in a variety of ways. First, an artfully crafted planting, along with a liberal application of leaf litter, can visually blend the disturbed site with the surrounding vegetation. This creates a passive, visual barrier which, since the site is no longer recognized as a trail or camp, reduces or eliminates subsequent recreational impacts. In addition, the planting activity provides a small scale de-compaction of soil as each element is planted. The brush also shades the immediate area,

providing an ameliorated microclimate of reduced temperature and improved moisture. Grand Canyon will incorporate these ecologically sensitive measures into its rehabilitation program.

Ripping (Decompaction) of Soil

Tillage, scarification, or ripping compacted soils allows water to penetrate much more easily, and this treatment is important, but not critical, in improving soil moisture. Because of the widespread presence of archaeological features in Grand Canyon, this practice will not occur unless specifically authorized by the Park archaeologist. Often, the freeze-thaw cycle affecting most of the Park generally breaks up soil surfaces to a sufficient depth for many grass species—provided additional impacts do not occur. If ripping is approved, a variety of methods will be used depending on the area’s extent. Generally, hand tools such as picks, shovels, pulaskis, and occasionally rock bars will be used for small areas. Stock-drawn rippers resembling plows may be used by qualified persons for larger-scale projects. Mechanical alternatives, a last resort, are addressed in Appendix D, Minimum Requirement Decision Process. Soils formed in arid and semiarid conditions are extremely shallow; ripping should involve soil de-compaction with an absolute minimum of soil mixing (Jackson, McAuliffe, and Roundy 1991).

Seeding

Seeding will be derived from local sources suitable to the restoration site.

Depending on the life of the seeds in the soil, an area might need to be re-seeded. If stands of native plants exist nearby, natural introduction of seeds may be adequate provided the site preparation work persists or is refurbished (Jackson, McAuliffe, and Roundy 1991; Day and Ludeke 1990). The value of fertilizers in arid and semiarid environments is questionable (Morgan 1994).

Some research and experience indicates that seeding in the fall will result in higher probability of seedling establishment. If fall-winter-spring precipitation is sufficient to start seedling emergence, midsummer moisture events may be very important in native seedling establishment. A commonly accepted rule of thumb for seeding grasses in rangeland seedbeds is to plant at a depth two and one-half times the diameter of the seed. Deep planting increases likelihood of adequate moisture, and may make it more difficult for rodents to locate and recover artificially planted seeds (Jackson, McAuliffe, and Roundy 1991).

Cryptogamic Crust

A cryptogamic crust is a brown, black, grey, or white soil cover composed of either algae, lichen, moss, fungi, or liverwort, alone or combined (Ladyman and Muldavin 1996). Living cryptogamic crusts should not be confused with inorganic desert crusts which appear similar to the organic structures, but reduce water infiltration and increase runoff and erosion. In contrast, the cryptogamic crust minimizes erosion and provides nitrogen to the soil (Fletcher

and Martin 1948; Harper and Marble 1988). As early as 1948, researchers observed that Southwest crusts composed of algae and lichen had the beneficial function of reducing erosion and adding organic matter to the soil (Fletcher and Martin 1948). There is a growing body of quantitative evidence that cryptogamic crusts are important in stabilizing soil against erosional forces, especially in arid and semiarid environments that cannot support lush grass growth and are particularly susceptible to erosion (See Ladyman and Muldavin 1996).

Microbiotic crusts are extremely fragile and are prone to destruction with slight impacts (Belnap 1993; Beymer and Klopatek 1992; Cole 1990a). Trampling by backcountry recreationists is capable of seriously impacting large areas. Very low levels of ongoing use will maintain high levels of disturbance. This shows most commonly as webs of trails that surround trail junctions, camping areas, and points of interest (Cole 1990a).

Although lichen and moss growth tends to be slow, other microbiotic crusts have the potential for rapid recolonization (Cole 1990a). Inoculation with cryptogam preparation is one way to hasten cryptogamic crust development (St. Clair, et al. 1984; Belnap 1993). Dry inoculation—crumbling material from one area spread as thinly and evenly as possible over another area—is an effective method. Studies indicate that inoculation contributes significantly to reestablishing crusts in as little as two

years, although not to levels of undisturbed sites (Belnap 1993). Studies conducted in Grand Canyon indicate surprisingly rapid recovery of crusts in as little as five years, provided the source of perturbation is eliminated (Cole 1990a).

Cryptogams are significant ecosystem components. They contribute to landscape stability and increasing nutrient status and biodiversity. In arid parks it is important to educate visitors about the nature, importance, and fragility of cryptogamic crusts. It is also important to locate trails, camping areas, and other activity sites away from places with well-developed crust and, where this is not possible, try to confine traffic to one well-developed route (Cole 1990a). Grand Canyon will consider cryptogam life forms when planning backcountry facilities, rehabilitation, and a sustainable ecosystem-management strategy.

Establish a Dependable Seed and Propagule Source

Seed Collection

The more plants from which seeds are harvested, the greater the chance that the collection will contain potentially important genes, and that these genes will be represented in the same frequencies as in the original population.

Grand Canyon National Park will choose plants from which to harvest seed in a random fashion, trying to avoid both conscious and unconscious selection by paying little attention to

plant phenotype. This will enhance the probability of including genes for survival under varying conditions, not just the conditions that contributed to the phenotype and the vigor of the plant at the time the seed was harvested (Knapp and Rice 1994).

Collecting seed from a population growing in a similar environment as the target environment, on both a regional and local scale, can increase the odds that a well-adapted germplasm will be selected for restoration. Without knowledge of the gene combinations that determine adaptation to a certain environment, the best we can do is to collect material from environments with potentially similar selection pressures as the planting site. Reasonable regional adaptation can also be attained by just selecting plant material from sites with similar elevation, latitude, climate, and so on as the site to be restored (Knapp and Rice 1994).

Less obvious, but perhaps equally important, genetic variation may be associated with local edaphic gradients, biotic factors, microclimate, and soils. Aspect of a site is another potentially strong local selective force, with plants growing on a sunny, southern exposure more likely to contain genes for drought stress than plants growing just over the hill on more shaded northerly slopes (Knapp and Rice 1994).

Cultivation and Nursery Considerations

If the seed cultivation (seed increase) environment is different from the even-

tual target environment, selective pressures may greatly alter the seed's genetic composition. The best way to avoid genetic shifts is to cultivate seed in an environment as similar as possible to the target site. In addition, upon replanting a seed-increase field, it is important to use originally collected seed, not seed from a previous seed increase (Knapp and Rice 1994). Grand Canyon will adhere to these specifications.

The Park currently has a nursery operation, including two greenhouses on the South Rim devoted to the propagation of native plants. In addition, the Science Center staff is developing a partnership relationship with Glen Canyon National Recreation Area to establish a native grass seed cultivation area at Lees Ferry.

Educate the Public and Workforce

An effective restoration effort requires an effective educational program (See Chapter 10, Interpretation, Education and Information). An educated public and workforce can effectively reduce the extent of recreational impacts that would otherwise require active restoration intervention. In addition, the public and staff needs to understand the need for restoration, not only to support such efforts, but also to decrease the likelihood of dismantling labor-intensive projects. An effective education program will be established to create

- a coordinated interpretive program to provide visitors access to adequate and

accurate information regarding protection of natural and cultural resources

- a coordinated wilderness education program for staff (permanent, seasonal, and volunteer) to develop resource protection and restoration skills. These include 1) wilderness management principles and philosophy; 2) Leave No Trace training; 3) application of minimum requirements, 4) development proficiency in the use of primitive tools; 5) development of minimum-impact trail maintenance, site restoration, and minimum-impact fire suppression tactics and techniques.

Implement Restoration/ Rehabilitation Program

Currently, two winter river trips (approximately 6 weeks total) are dedicated to the restoration and rehabilitation of impacts within the proposed wilderness. Work crews of paid and volunteer staff conduct site restoration and revegetation, trail maintenance, and exotic plant control in remote locations throughout the inner canyon. Additional volunteer crews are occasionally organized to perform similar work on the rims during the summer.

Park staff will continue to expand its partnership relationships with conservation groups, schools, and other agencies in order to achieve restoration goals.

Develop an Effective Monitoring Program

Grand Canyon will implement an effective monitoring program which evaluates restoration treatment effectiveness (See Chapter 12, Monitoring and Research). All the good intentions in the world will not guarantee a successful restoration program without adequate evaluation of the techniques used.

13.3 summary of changes and actions

- The Park will continue its winter river-based restoration program. This will be accomplished during two three-week trips, and will generally consist of work parties of 16 crew members.
- Park staff will continue and expand supplemental restoration programs, including the establishment of partnerships with governmental and nongovernmental organizations.
- The Park will continue its plant nursery program. Science Center staff will develop, in cooperation with Glen Canyon National Recreation Area, a native grass cultivation program.

CHAPTER

14

Cultural Resources Management

14.1 Issues and Public Concerns

Through the Scoping process for this Plan, public comments concerning cultural resources were received; the majority related to site-preservation efforts and education. Numerous comments were received suggesting ways to better protect archeological resources. Improved education, in a variety of formats, was by far the most common suggestion. Posting notices on archeological sites, closing sites, increasing interpretive information provided to hikers, educating park personnel, increasing patrols, and adding information to written guidebooks were all suggested to mitigate site impacts. Education is the most important aspect of an active approach to management, and is discussed in Chapter Ten. On-site mitigation efforts, increased monitoring and signage, and active changes in trails and designated campsites are discussed in this section and also in Chapter 12, Archeological Monitoring, and Chapter 16 Implementation Plan and Schedule.

14.2 Program Overview

The Cultural Resource Management Program at Grand Canyon is devoted to the management of program requirements, maintenance, ongoing projects, and activities. Cultural Resources Program include archaeology, ethnography, curation, cultural landscapes, historic preservation and American Indian consultation. All these elements are a component of wilderness management at Grand Canyon.

Cultural resources management is mandated by law and policy. Major historic preservation laws include the Historic Sites Act of 1935, the National Historic Preservation Act of 1966 (as amended 1992), the National Environmental Policy Act of 1969, the Archeological and Historic Preservation Act of 1974, and the Archeological Resources Protection Act (ARPA) of 1979 (as amended 1988). Of particular importance are additional documents such as *NPS Management Policies* (1988), the Antiquities Act of 1906, the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, and Executive Order 13007 Indian Sacred Sites signed May 24, 1996.

The primary objective of the Cultural Resource Management Program is to meet the basic requirements outlined in the Cultural Resource Management Guidelines, (NPS-28) to ensure cultural resources are identified, properly managed, and preserved. This objective is accomplished through a systematic program of research, planning, and stewardship.

According to *NPS Management Policies* (5:2), the NPS will conduct a coordinated program of basic and applied research to support planning for and management of park cultural resources. In addition, *NPS Management Policies* (6:7) states

Cultural features such as archeological sites, historic trails or routes, or structures that have been included within wilderness will be

protected and maintained using methods that are consistent with the preservation of wilderness character and values and cultural resource protection requirements.

Cultural resources management within the Park's wilderness areas is focused on archeological resources (historic and prehistoric), ethnographic resources (traditional cultural properties and access accommodations), historic resources (buildings, trails, landscapes), and objects (artifacts preserved *in situ*).

14.3 Archeological Resources

Archeological resources are those physical remains that provide the basis for understanding and interpreting prehistory and history. Of all cultural resources found in Grand Canyon, the greatest conflict in visitor use and management relates to archeological resources. This situation is caused, in part, by the fact that humans have used the Grand Canyon for thousands of years—a good route prehistorically has become a good trail today; a good campsite 1000 years ago was a good campsite 100 years ago, and is still a good campsite. Remains of prehistoric and historic activity is evident in a large portion of the more popular wilderness use areas.

As stated in Chapter Two of this Plan, the existing inventory of archeological sites is based on a survey of only two percent of the Park. Most of the inventory has been conducted along the Cross-Canyon Corridor trails, the pri-

mary wilderness trails, and near popular use areas such as Hermit Creek and Tanner. The monitoring program focuses primarily on sites located at existing and potential camp or day use areas (See Chapter 12.3, Monitoring and Research Programs).

Monitoring by itself can not mitigate the impacts that have already occurred or are currently occurring to archeological resources. Monitoring provides the means of tracking and evaluating the condition of archeological resources so that managers can develop appropriate protection actions. Law enforcement and public education provide avenues for preventing future impacts but cannot address the impacts which have already occurred. For long-term monitoring to be worthwhile, it is essential that the monitoring program be directly linked with other treatment programs that can address the ongoing impacts to these nonrenewable heritage resources through stabilization, rehabilitation, or, if no other reasonable options are available, through site closure or excavation.

Specific treatments to mitigate impacts to archeological sites, especially in the more popular wilderness areas include designating campsites to concentrate use in areas with high concentrations of archeological resources, and to reroute and redesign trails to avoid impacts from foot traffic. These management actions are identified for specific areas in Chapter Sixteen, Implementation Plan and Schedule.

*Every place,
like every
person, is
elevated by
the love and
respect shown
toward it, and
by the way in
which its
bounty is
received.*

*Richard Nelson
The Island
Within*

14.4 Ethnographic Resources

An ethnographic resource is any natural or cultural resource linked to the traditional practices, values, beliefs, history and/or ethnic identity of a cultural group or groups. Specific direction on management of these resources is found in NPS-28 and *NPS Management Policies*. In addition to specific NPS direction, legal direction is also found in the American Indian Religious Freedom Act, the Religious Freedom Restoration Act, and Executive Order 13007 (Indian Sacred Sites).

Grand Canyon has been home to various groups for thousands of years. These people, both American Indian and more recent Euro-Americans, have used the Canyon as both a home and a place linked to traditional practices, values and beliefs. Euro-Americans recognized the Canyon's spiritual values in the establishment of the national park in 1919. World Heritage designation told the world that Grand Canyon had value beyond the American people. The 1975 Grand Canyon Enlargement Act specified natural quiet and the view as important, yet intangible qualities, that must be protected. These are all ethnographic resources.

Through the integration and improvement of resource management, visitor experience, and personnel sensitivity, the ethnographic program seeks to raise the level of the public's and park personnel's understanding and appreciation for natural, cultural, and ethnic diversity.

Tribal interest in management of wilderness areas at Grand Canyon National Park is significant. The Park's management staff is committed to ongoing integration of Tribal perspectives into Park programs. Effective government-to-government relationship with eight separate Indian Tribes (represented by six Tribal governments) will be maintained through the Cultural Resource Management Program.

Traditional Cultural Properties

Closely linked with ethnographic resources, *traditional cultural properties* (TCP) are defined as "one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (U.S. Department of the Interior, National Park Service, Undated). Given the thousands of years of American Indian association with the Canyon, it is likely that many traditional cultural properties can be defined in the Park. Locations can only be defined by those cultural groups whose association with Park resources and values can be defined within National Register contexts. Ongoing consultations with groups affiliated with Grand Canyon National Park will further identification of important traditional cultural properties.

Access and Accommodation

On May 24, 1996, President Clinton signed Executive Order 13007 to accommodate access to American Indian sacred sites by Indian religious practitioners, and to provide additional protection for the physical integrity of such sites on Federal lands. EO 13007 directs the NPS (and other Federal agencies) to accommodate access to and ceremonial use of sacred sites by American Indian people to the fullest extent possible under the law.

Wilderness areas of Grand Canyon National Park are likely to contain locations of importance to American Indian religious practitioners, requiring accommodation for access and use. *NPS Management Policies* (6:7) is specific when referencing cultural resources and American Indian use in wilderness areas, and implementation of EO 13007 will be consistent with existing policy:

Cultural features such as archeological sites, historic trails or routes, or structures that have been included within wilderness will be protected and maintained using methods that are consistent with the preservation of wilderness character and values and cultural resource protection requirements.... Native American religious areas and other ethnographic resources will be inventoried and protected. Native Americans will be permitted non-motorized access within wilderness for sacred or religious purposes in accordance with criteria for special park uses.

NPS wilderness policy and management does not preclude accommodation and use of sacred sites. In contrast, NPS management has the ability to embrace and implement the broad provisions of EO 13007.

14.5 Historic Resources

Historic resources are those buildings, trails, and objects that have achieved their significance during the recent past. At Grand Canyon, literally hundreds of buildings and hundreds of miles of trails are considered significant historic structures. A structure is a "constructed work...consciously created to serve some human activity."

Although by its very nature, wilderness areas are typically devoid of evidence of recent human activity, wilderness areas may contain features of historical value. Proposed wilderness within the Park contains significant historic structures, mainly in the form of constructed trails. These trails represent a continuum of use, from prehistoric to historic times, and are the link between the rim and inner canyon. Historic trails may serve and be maintained as part of the wilderness trail system (*NPS Management Policies*, 6:2).

Cultural Landscapes

A cultural landscape is "a geographical area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with an historic event, activity, or person or exhibiting other cultural or

aesthetic values.” In the broadest sense, a cultural landscape reflects human adaptation and use of natural resources. This is often evident in the division and organization of the land, the presence of both natural and cultural biotic features, the systems of circulation that allow movement, and the types of structures that are built. A cultural landscape’s character is defined by physical material, use, and function. Individual features, such as roads, buildings, walls and vegetation are material components that, taken together, create the whole landscape. Patterns of use and function reflect cultural values and traditions. The Grandview Trail leading to Horseshoe Mesa and the Last Chance Mining District is considered a cultural landscape.

14.6 Objects

Although we typically think of historic objects as curatorial materials within museum collections, preservation *in situ* (in its original place) is often the preferred management decision. The range of historic and prehistoric objects found in Grand Canyon’s wilderness is wide, from broken pottery and projectile points to cast iron stoves, tin cans and wooden burro panniers. All of these objects are part of the cultural landscape, the archeological site, or the historic resource, and are afforded the same protection as other cultural resources.

Collection of objects, be they historic or prehistoric, is not undertaken by archaeologists without clear program definition and research orientation. “Park archeological resources are left *in situ* and

undisturbed, unless removal of artifacts or intervention into cultural material is justified in the planing process by preservation treatment, protection, research, interpretation, or development requirements. They are preserved in a stable condition to prevent degradation and loss of research values or *in situ* exhibit potential” (U.S. Department of the Interior, National Park Service 1994a). Tribal consultations have recommended that archeological remains be left in their original location if at all possible. Objects that are collected are curated in Grand Canyon’s Museum Collection.

14.7 Native American Graves Protection and Repatriation (NAGPRA)

NAGPRA was signed into law by President George Bush on November 16, 1990. This law addresses the rights of lineal descendants, Indian Tribes, and Native Hawaiian organizations to certain Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony with which they are affiliated. All provisions of implementation specified in NAGPRA and its implementing regulations will be followed by Grand Canyon.

The possibility of inadvertently discovering American Indian human remains, funerary objects, sacred objects or objects of cultural patrimony within Park wilderness is very real. Although human remains are rare in the archeological inventory, we acknowledge that human

remains could be found anywhere people have lived and traveled. Grand Canyon National Park will enter into agreements with affiliated Tribes regarding inadvertent discoveries. Ongoing consultations with Tribes affiliated with the Canyon suggest that *in situ* preservation and reburial as close to the original location as possible are preferred. The details related to appropriate treatment under NAGPRA will be included in individual Memoranda of Understanding (MOU). Until such time as individual MOUs are in place, provisions specified in the final rule for NAGPRA §10.4 will be followed.

14.8 Cultural Resource Stewardship

Responsibilities are accomplished by many Park units, with the majority carried out by the Cultural Resource Management Program. The Division of Maintenance is involved in cultural resources preservation through historic structures, trails, and landscapes. The Division of Visitor and Resource Protection is key to cultural resource protection. Through ARPA-related patrols and monitoring efforts with the archeological staff, evaluations and recommendations for management actions are presented to the superintendent.

In addition, the Cultural Resource Program Manager, serves as liaison with the eight affiliated American Indian Tribes. An active consultation process involves working in cooperation with the affiliated Tribes when proposed management actions have potential impact to cultural resources and values.

14.9 Summary of Changes and Actions

Figure 14.1

summary of changes and actions

Program Area	Management Actions	Stewardship Responsibilities
Archeological Resources <ul style="list-style-type: none"> •Prehistoric •Historic 	Inventory and Monitoring Site Protection Site Preservation Education	Archaeologist Wilderness Ranger Trail Crew Interpreters
Ethnographic Resources <ul style="list-style-type: none"> •Traditional Cultural Properties •Access Accommodations 	Consultation Education	Cultural Resource Manager Archaeologist Interpreters
Historic Resources <ul style="list-style-type: none"> •Buildings, Trails, Roads, Objects •Cultural Landscapes 	Inventory and Monitoring Site Protection Site Preservation Education	Archaeologist Wilderness Ranger Maintenance Crew Interpreters
NAGPRA	Consultation Development of MOU	Cultural Resource Manager Archaeologist Wilderness Ranger

CHAPTER

15

Havasupai Traditional Use Lands

15.1 Issues and Public Concerns

Access to Park lands through the area known as the Havasupai Use Lands was another concern identified during the public scoping process. The majority of concerns were expressed by individuals who cross the Great Thumb and Esplanade, included within the Havasupai Use Lands, to Park areas around Royal Arch and Elves Chasm. This chapter addresses access and permitting on Havasupai lands adjacent to the Park (See also Chapter Five, Backcountry Permits System; and Appendix E, Recreational Opportunities and Permit Information for Adjacent Lands).

15.2 Background

The Grand Canyon Enlargement Act of 1975 (Public Law 93-620), greatly enlarged Grand Canyon National Park by incorporating Marble Canyon National Monument, Grand Canyon National Monument, and portions of lands previously administered by the Bureau of Land Management and Lake Mead National Recreation Area into the legal boundaries of Grand Canyon National Park. In addition to enlarging the Park, significant additions were made to the Havasupai Reservation. Section 10 (a) of the Act provided an additional 185,000 acres to be held in trust by the Federal government for the Havasupai Tribe. Subsection (b)(6) of the Act states

...nonmembers of the tribe shall be permitted to have access across such lands at locations established by the Secretary in consultation with the Tribal Council in order to visit adjacent parklands, and with the consent of the tribe, may be permitted (i) to enter and temporarily utilize lands within the reservation in accordance with the approved land use plan described in paragraph (4) of this section for recreation purposes or (ii) to purchase licenses from the tribe to hunt on reservation lands subject to limitations and regulations imposed by the Secretary of the Interior.

(7) except for the uses permitted in paragraphs 1 through 6 of this section, the lands hereby transferred to the tribe shall remain forever wild and no uses shall be permitted under the plan which detract from the existing scenic and natural values of such lands.

In addition to the description of lands added to the reservation, Section 10(e) of the Act directed the Secretary of the Interior to “permit the tribe to use lands within Grand Canyon National Park which are designated as Havasupai Use Lands.” This provided Havasupai use “for grazing and other traditional purposes” of 95,300 acres of Grand Canyon National Park generally known as the Esplanade, and extending approximately from Royal Arch Creek on the east to National Canyon on the west.”

15.3 Management of the Havasupai Use Lands

In 1982, Grand Canyon National Park and the Havasupai Tribe developed a Memorandum of Understanding (MOU) (U.S. Department of the Interior, National Park Service 1982a) which governed the use of what has become known as the Havasupai *traditional use lands* (TUL). Although the MOU lapsed in 1987, incorporation of the essential elements of the agreement into the Wilderness Management Plan will continue to provide guidance to Grand Canyon National Park management and the Tribal government regarding use and access on the TUL.

- Both the National Park Service and the Havasupai Tribe concur that the Tribe retains grazing rights in the TUL consistent with acceptable range-management practices for the particular acreage.
- The Havasupai will not graze sheep in the TUL, and horses presently grazing in the TUL that are unclaimed will be removed by the Havasupai. Havasupai livestock in the TUL will be branded.
- Consistent with traditional use, the Havasupai may hunt in the TUL, except in the summer, in such a manner as is consistent with acceptable wildlife-management practices, and concurred in by the Secretary of the Interior. Individuals who are not members of the Havasupai Tribe will not be permitted to hunt in the TUL. Bighorn sheep, predators, and rare and endangered species

will not be hunted. Problem predators will be reported to Grand Canyon National Park management, and a joint and mutually satisfactory solution developed.

- As originally identified in the Act, Havasupai use of the TUL will continue for traditional purposes. This includes gathering edible wild plants, materials for paints and medicines, other legitimate traditional substances, and minimally improving existing springs to maximize available water for wildlife and visitors in such a manner that the natural and scenic beauty of the TUL will not be marred.

- Grand Canyon National Park will limit visitor access to the TUL from the Havasupai Reservation to two trails leading from the rim: the Apache Point Trail and the 140 Mile Canyon Trail. Permits will be granted only to experienced hikers who request them. Visitors remaining overnight in the TUL must have Grand Canyon National Park permits, and, to access and/or camp on the Havasupai Reservation, Tribal permits. Grand Canyon National Park will forward individual permit information to the Tribe whenever overnight hikers access the Park via Tribal lands. Confirmation of a Tribal permit will be required prior to issuing a Grand Canyon backcountry permit. For the benefit of those visitors permitted to hike across the Great Thumb to the head of Apache Point and/or 140 Mile Canyon Trails, the Havasupai Tribe will designate adequate parking facilities on the Topocoba Hilltop Road and, by means of a sign, bulletin

*There may be
people who
feel no need
for nature.
They are
fortunate,
perhaps.
but for those
of us who feel
otherwise, who
feel something
is missing
unless we can
hike across
land disturbed
only by our
footsteps
or see
creatures
roaming freely
as they have
always done,
we are sure
there should
be
wilderness.*

*Margaret E.
Murie*

board, or other appropriate information device, inform the visitor of Tribal regulations to be observed while crossing the reservation to gain Park access.

- No vehicular access or use of horses by non-Tribal members will be permitted on the Great Thumb north of the Topocoba Road and north and west of a line running south from Forster Canyon, except in an emergency, such as when human life is endangered, for forest-fire suppression, and for official Park administrative and protective functions. Havasupai Tribal members may guide nonmembers on Tribal horses in the TUL.

- Numbers of visitors permitted in the TUL have been determined and are consistent with hiker limitations in other areas of the Park. These areas are managed as “wild” zones, with no more than two hiking groups and a maximum of 16 people permitted within the TUL at any given time, with a maximum stay in each area not to exceed seven nights.

- All visitors to the traditional use area, regardless of route or access, will at all times abide by NPS regulations and/or hiking permit conditions (See Chapter Four, Recreational Use of Wilderness). In addition, visitors to the traditional use area must pay particular attention to the following permit conditions

- No firearms
- No open campfires
- No removal of, marking on, or breaking any natural object

- No removal or disturbance of archeological materials, artifacts, or ruins
- No camping at springs, archaeological sites, or around Mt. Sinyella
- During foot travel across the Great Thumb, whether on Tribal or Park land, visitors will use what has been called the Great Thumb Jeep Trail. Camping will be permitted within 50 yards (45 meters) of the trail
- No permits will be issued to climb Mt. Sinyella
- Visitors seeking water near 140 Mile Canyon should obtain it only from the spring running along the bottom of the wash at the head of 140 Mile Canyon
- Visitors must not disturb Tribal livestock

15.4 Native American Graves Protection and Repatriation Act

Although the provisions related to the Native American Graves Protection and Repatriation Act (NAGPRA) were discussed in Chapter Fourteen, mention of law in relation to TUL management is appropriate. The TUL, as land within Grand Canyon National Park, is subject to the same provisions regarding implementation of NAGPRA for all other areas of the Park. However, Havasupai traditional use of the TUL presents a unique opportunity to work cooperatively with the Tribe in the development of appropriate treatment for human remains and sacred objects discovered within the TUL.

A specific agreement will be developed with the Havasupai Tribe regarding inadvertent discoveries on the TUL. Although identification of cultural affiliation is critical, consultation with the Havasupai and other affected Tribes will be used in drafting a Memorandum of Understanding related specifically to the Havasupai use lands within Grand Canyon National Park.

15.5 Culturally Sensitive Areas

Certain reservation and TUL areas hold special meaning to the Havasupai people. These areas, discussed in general in Chapter Fourteen as traditional cultural properties, ethnographic resources, and sacred areas, are defined by the Tribe. Grand Canyon National Park will incorporate information provided by the Tribe in an attempt to protect the physical and spiritual integrity of those places and use as defined in EO 13007. (See Chapter 14, Cultural Resources Management).

15.6 Summary of Changes and Actions

- Incorporate essential elements of the MOU governing the use of the TUL including actions related to traditional uses and visitor access
- Establish a cooperative permitting system with the Havasupai Tribe that includes exchange of information on requested visitor use of the area, and confirmation on permit issuance from either the Park or the Tribe. (See also Chapter 5, Backcountry Permit System)
- Under the provisions of NAGPRA, develop a specific agreement with the Havasupai Tribe regarding the inadvertent discovery of human remains on the TUL
- Under the provisions of EO 13007, incorporate information provided by the Havasupai Tribe on culturally sensitive areas, and assure accommodation of the traditional use of these areas.